Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Implementation of Section 17	)	ET Docket No. 93-7
of the Cable Television	)	
Consumer Protection and	)	
Competition Act of 1992	)	
	)	
Compatibility Between	)	
Cable Systems and Consumer	)	
Electronics Equipment	)	

NOTICE OF INQUIRY

Reply Comments of Scientific-Atlanta

Scientific-Atlanta is a world leader in broadband communications systems, satellite-based communications networks and instrumentation for industrial, telecommunications and government applications.

The company is a recognized worldwide leader in the development and manufacture of cable television equipment used in more than 100 countries and 9,000 local cable sites in the United States, in both analog and digital formats. Scientific-Atlanta is a leading supplier of subscriber systems to cable operators, with over six million addressable and eight million non-addressable cable converters installed throughout the U.S. The company is participating in the EIA-NCTA Committee which is attempting to address the issues in this notice.

These reply comments to the FCC Notice of Inquiry on equipment compatibility are aimed at the comments submitted by several entities on the subject of the EIA 563 multiport interface standard.

It has been asserted by some filers that the EIA 563 multiport concept is not compatible with future trends in cable technology, particularly digital compression technology. It is our assertion that the EIA 563 multiport standard is compatible with the future trends in cable technology, and can easily be adapted for use with both HDTV and digital compressed video signals.

Attached are two documents supporting that assertion application of the multiport of the future. Use of the EIA 563 multiport connector with digital compression.

Scientific-Atlanta continues to take the position that no one solution will address cable - consumer electronics compatibility issues.

Scientific-Atlanta has recommended several solutions for the existing base, including advanced addressable home terminals, dual tune/descramble terminals, and enhanced remote controls, and interdiction technology. The EIA 563 multiport interface device will not solve all of these problems, particularly in existing TV's and VCR's.

However, we believe that the EIA multiport interface can be compatible with future technologies, and we ask the commission to reject arguments to the contrary, in light of our detailed analysis presented here.

USE OF THE EIA563 MULTIPORT CONNECTOR WITH DIGITAL COMPRESSION

Scientific-Atlanta, Inc.

The EIA Multiport was developed several years before the industry was thinking of digital compression to transmit programming to subscribers, but it is suitable for this use with one addition.

An IF output from the TV is needed. The reason is that transmission of compressed video will likely use a multi-level digital modulation system, and this is not compatible with a conventional AM vestigial sideband system as is used for conventional NTSC analog TV transmission.

Figure 1 shows the idea behind the use of Multiport with compression. The cable still is routed into the TV first. The TV provides an IF output developed at the output of the tuner. This goes to the digital compression decoder. In addition, the Multiport (EIA-563) connector is used. The modulated IF signal is demodulated by a suitable demodulator in the decoder, which develops video in the conventional NTSC format (and likely in other formats), as well as stereo audio. These are routed back to the TV via the Multiport connector. In addition, the Multiport decoder is the vehicle through which control signals pass in each direction.

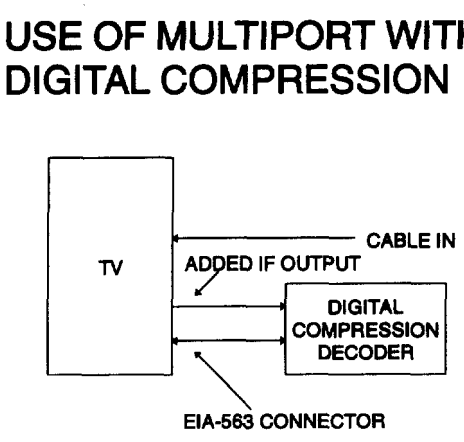


Figure 1

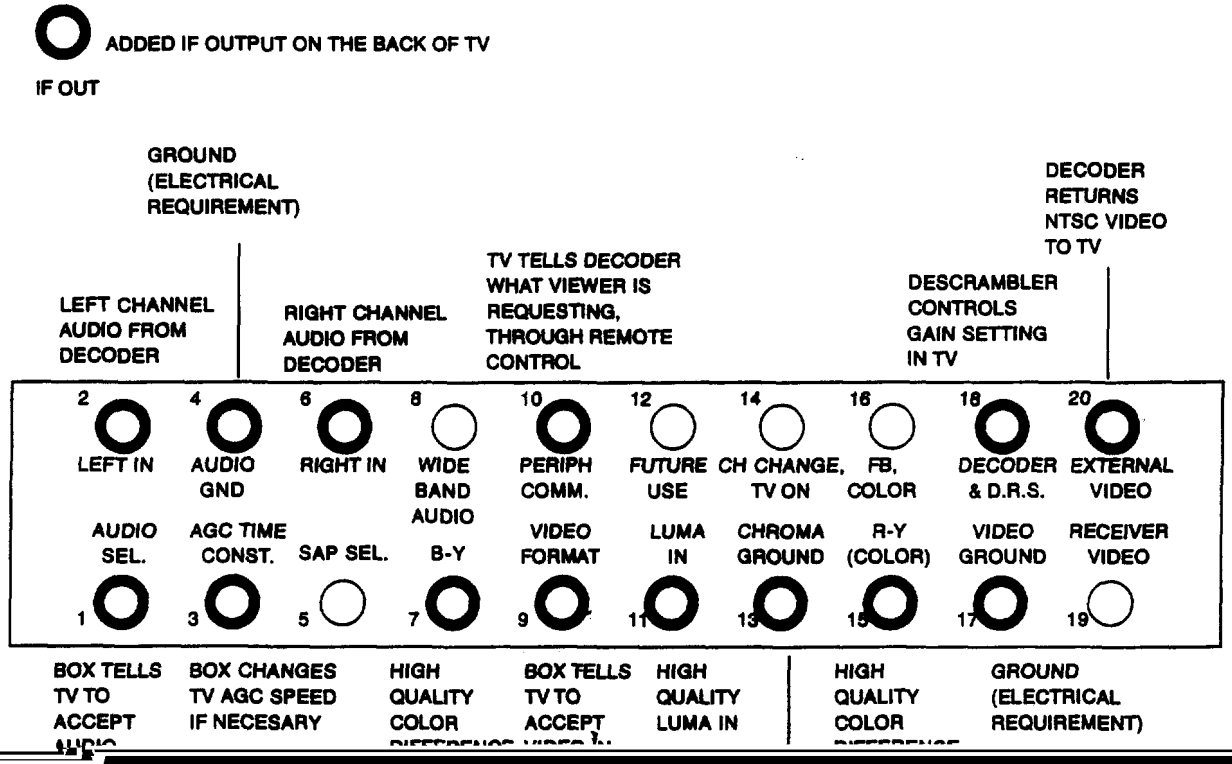
Operation of the TV is the same when receiving compressed signals as it is when receiving NTSC signals. The subscriber doesn't know the difference between the two. This method may also be used to provide an early entry HDTV system. When the HDTV standard is ready for deployment, a difficult situation will exist, in that broadcasters will have little incentive to transmit HDTV because consumers won't have the HDTV receivers. Consumers, on the other hand, will have little incentive to spend a lot of money on HDTV sets until there is programming, and the sets come down in cost. With little market for sets, the manufacturers will not be able to bring costs down.

One way to overcome this is to provide an HDTV adapter, which is most conveniently used with the Multiport connector. The adapter will look the same as the compression decoder shown in figure 1. Consumers would be able to buy somewhat more reasonably priced HDTV decoders to use with their Multiport-equipped NTSC sets. This will allow

some advantages of HDTV, as we shall show below. The consumer will still have incentive to buy an HDTV set, because this is the only way he will be able to get a wide screen picture.

In order to allow use of a Multiport adapter with HDTV, it will be necessary to include "Pan and Scan" information in the HDTV signal. This is used by the adapter to show the most important part of the wide screen picture on conventional NTSC narrow screens.

1. DIGITAL DECODER INTERFACE



Pin 1 tells the TV to accept audio from the decoder.

Pin 2 is the left audio from the decoder, which derives audio from the digital data stream.

Pin 3 controls the AGC speed in the TV. This may be necessary in some cases to facilitate recovery of the digital signal.

Pin 4 is the audio ground, and is required for high quality audio performance.

Pin 6 is the right audio in from the decoder.

Pins 7, 11 and 13 provide for the highest quality input from the decoder. In order to provide color in the same bandwidth as black and white, the NTSC system had to compromise on sharpness. We can overcome this with HDTV, but if we have to put the signal back into NTSC to deliver to the TV, we loose the advantage. These pins allow us to send signal to the TV in luminance and color difference format, which allows much better quality. As an alternative, the standard provides for S-VHS Y-C interface. This is intermediate in quality between NTSC and color difference transmission. For compressed signals, we are not likely to be able to take advantage of quality over that provided by the Y-C interface. For HDTV, however, we could use the extra quality. For the Y-C interface, pin 7 would not be needed.

Pin 10 is for peripheral communications, and will be used to tell the decoder how to operate. While the decompression function per se may not need instructions from the TV, it is certain that the decoder will also perform program denial functions, such as accepting an order for an impulse pay-per-view program. For these functions, it will be necessary to allow the subscriber to control the decoder through pin 10.

Pin 18 is needed because the AGC circuits in an NTSC TV aren't suitable for controlling gain of the digital signal. The decoder bears the burden of controlling the set point of the AGC, and does so by providing on pin 18, an NTSC-like sync signal which varies in amplitude in the manner the AGC detector expects from an NTSC signal.

Pin 20 is the input from the decoder which would be used if interface using NTSC is to be used. While not desirable from a quality point, it may be that provision should be made for NTSC video return to allow a manufacturer to provide a lower cost TV if he feels he can do so by accepting only an NTSC signal. Alternatively, a decoder manufacturer may find that he can build a more economical decoder if he only returns video in NTSC format.

The other pins are grounds. Multiple grounds are needed to allow high quality signal transmission.

In order to use the tuner in the TV for digital transmission, it must meet some specifications that are beyond those required for NTSC. Our tests indicate that they required specifications are well within the state of the art in tuner design. Very likely, it will be appropriate to use a double conversion tuner, but this is being done is some cases for NTSC transmission now, because it has advantages over a single conversion tuner.

The specifications which a tuner will want to meet are currently estimated to be the following.

Frequency response: Flat to 1 dB peak to peak across 5 MHz.

Delay response: Flat to 20 nS peak to peak across 5 MHz.

Local Oscillator phase noise in 1 Hz bandwidth:
- 100 Hz displacement: -28 dB
- 1 KHz displacement: -56 dB
- 10 KHz displacement: -85 dB
- 100 KHz displacement: -105 dB

1 APPLICATION OF THE MULTIPORT CONNECTOR IN THE FUTURE

National Cable Television Association

With modern TV sets, it is not always necessary to use a cable box, except that premium programs are usually scrambled in order to deny access to non paying subscribers. The cable box is still necessary in order to descramble premium signals. Unfortunately, this use of the box gets in the way of a lot of things that the subscriber would like to do. The problems of using a box are well known to many cable subscribers, but the alternatives have a lot of problems. The 1992 cable law will likely make scrambling more important in the future.

The Multiport connector was originally conceived as a more satisfactory way to connect a TV and a cable box, making premium TV viewing easier for the subscriber. At the time, the developers recognized that Multiport could solve problems even beyond descrambling. Additional provisions were made to accommodate these functions, even though they were not well defined at the time. As a tribute to the original developers, as we have prepared this contemporary summary, we have considered applications that had not been proposed in the mid 80s, when the standard was developed. The contemporary applications fit nicely within the standard developed at that time. Were we to start again to define a connector with the same functionality, it is unlikely that we would come out with a substantially different definition than we have now, though a few extensions would be made.

In this document, we show some of the applications for multiport, illustrating the various ways to use the pins we have. All of the present pins are useful, though we have one pin, for SAP, that could probably be defined slightly differently now. In the appendix we shall discuss the impact on eliminating various functions.

Figure 1 shows three uses for the Multiport connector. The top application was the prototype application for which Multiport was developed. This application replaces the cable box with a simpler "set back" box, which literally can be placed in back of the TV set, out of the consumer's way. On channels which don't need to be descrambled, the box does nothing. On channels which are scrambled, but for which the consumer has not paid, the box can eliminate any picture or sound on the screen. This is a real service to the subscriber who might be offended by material on some channels. On scrambled channels to which the consumer has subscribed, the box begins descrambling, with the consumer not knowing that it happened.

Pay-per-view events can be ordered if the box is suitably equipped, using the TV remote control to order.

The consumer gets back all of the features of his TV set, including unobtrusive use of his remote control, picture in picture, etc. With suitable connection, he can watch one thing

and record another without having to worry about what is and is not scrambled,[1] and without having complex RF switching schemes, which are confusing and which often cause problems of their own.

A second application for Multiport is shown in the center of figure 1. Super VHS (S-VHS) tape recorders are available today, which offer better picture quality than do conventional VCRs. They must be connected to the TV differently than are conventional VCRs, in order to take advantage of much of the improvement. The S-VHS standard was introduced late in the development of the Multiport, but the standard can accommodate S-VHS.

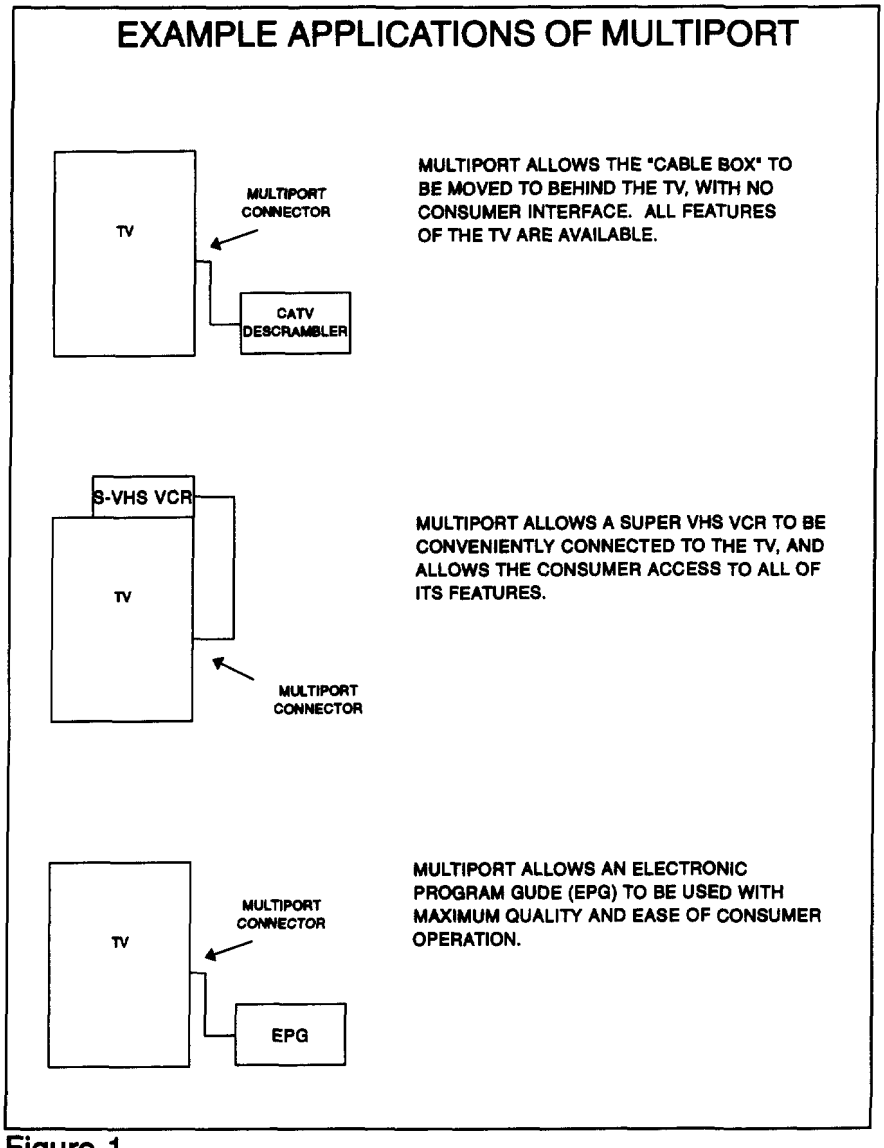


Figure 1

A third application of Multiport was not even conceived until after the standard was adopted. This is shown in the bottom of figure 1. Electronic Program Guides (EPGs) are being developed now to ease the confusion of subscribers, as the choice of programs has increased. In today's world, the subscriber may have up to nearly 80 program choices. In this environment, selecting the program by consulting a printed program guide, finding the channel number

[1]A second box will be needed if both the channel being viewed and the channel being recorded are scrambled. This will not pose the same problems it does today: when the Multiport box reaches current set top volume production, it will be less expensive, making it easier for the consumer to have two boxes. Since the box doesn't include a remote control, the confusion of multiple remotes is reduced.

(not always an easy task itself today) and tuning the TV, takes so long that a great deal of the program can be shown while the poor consumer is trying to find the program he wants.

To ease this, EPGs are being proposed. A subscriber will use an EPG by activating it with his remote control. When he does, a program guide will appear on his screen. Using his remote control, the subscriber peruses the EPG, looking for something he likes. As he moves from one program to another, the one he is considering is highlighted. When the subscriber selects the program, the TV automatically tunes to it. Because it is necessary to put many small characters, and possibly graphics, on the screen, it is not possible to do this by making up a composite NTSC TV signal of the kind we normally deal with, and expect the lettering to look good. The lettering will look much better if we can get into the TV with what are called "color difference signals," as well as with the black and which (luma) information. This is possible with the Multiport standard.

A DETAILED APPLICATION OF MULTIPORT TO THE ABOVE

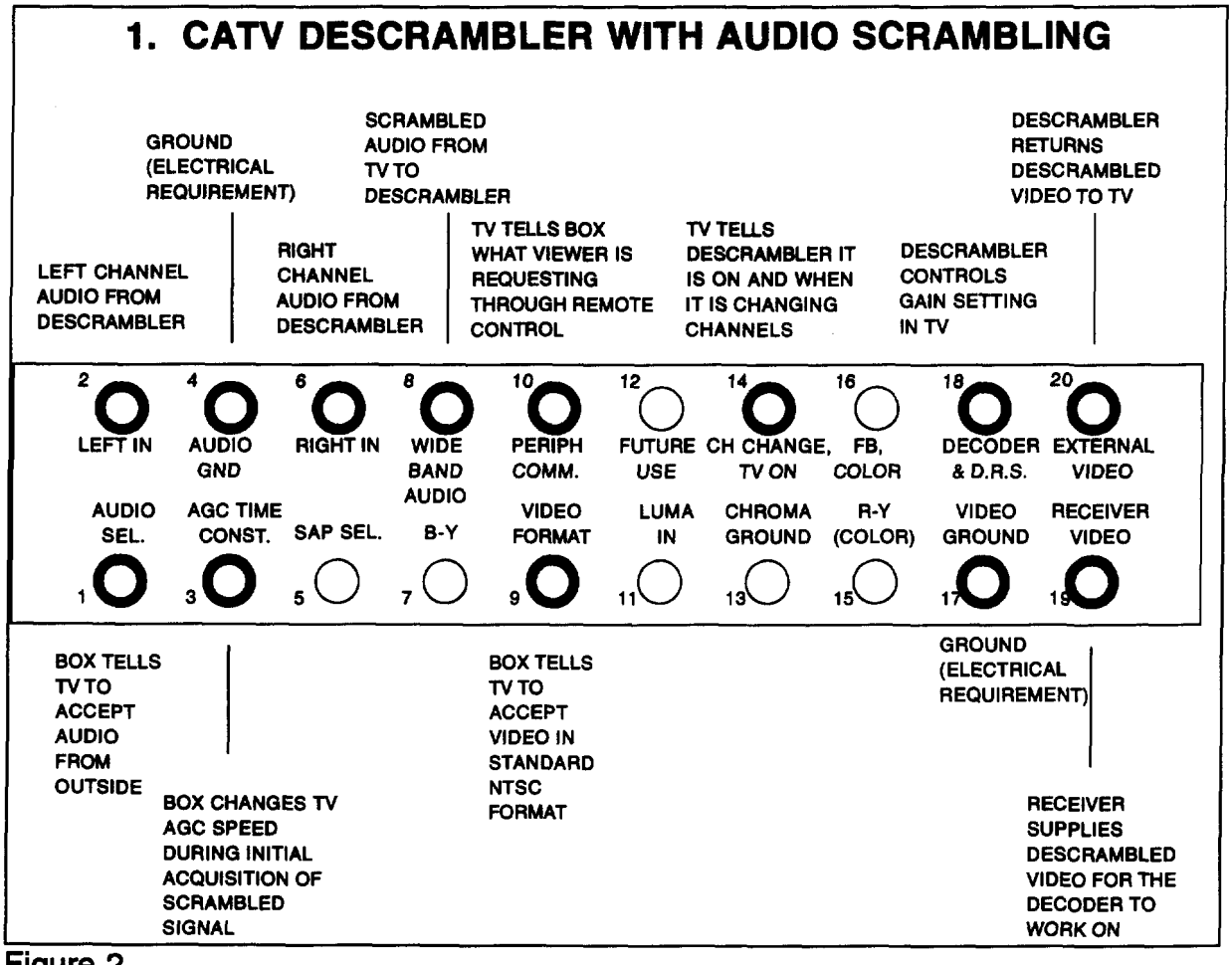


Figure 2

Figure 2 shows the application of Multiport to the cable box. The highlighted connections are used. We assume that the signal being received is scrambled, with stereo audio hidden in the audio portion of the signal. The subscriber controls tuning with his remote control, including possible access to impulse pay-per-view programs, which he can order from his remote control. The TV recovers the scrambled video and audio, and sends them to the CATV descrambler shown at the top of figure 1. Each of the pins in the connector is used as shown, to effect this process. Scrambled video is sent to the descrambling box on pin 19, and scrambled audio is sent on pin 8. The descrambling box returns descrambled video on pin 20, and descrambled stereo audio on pins 2 and 6. The box sets the TV to switch to the correct sources, using pins 1 and 9. The TV tells the box what to do, using pins 10 and 14. The other pins are needed for technical reasons, to make the system work.

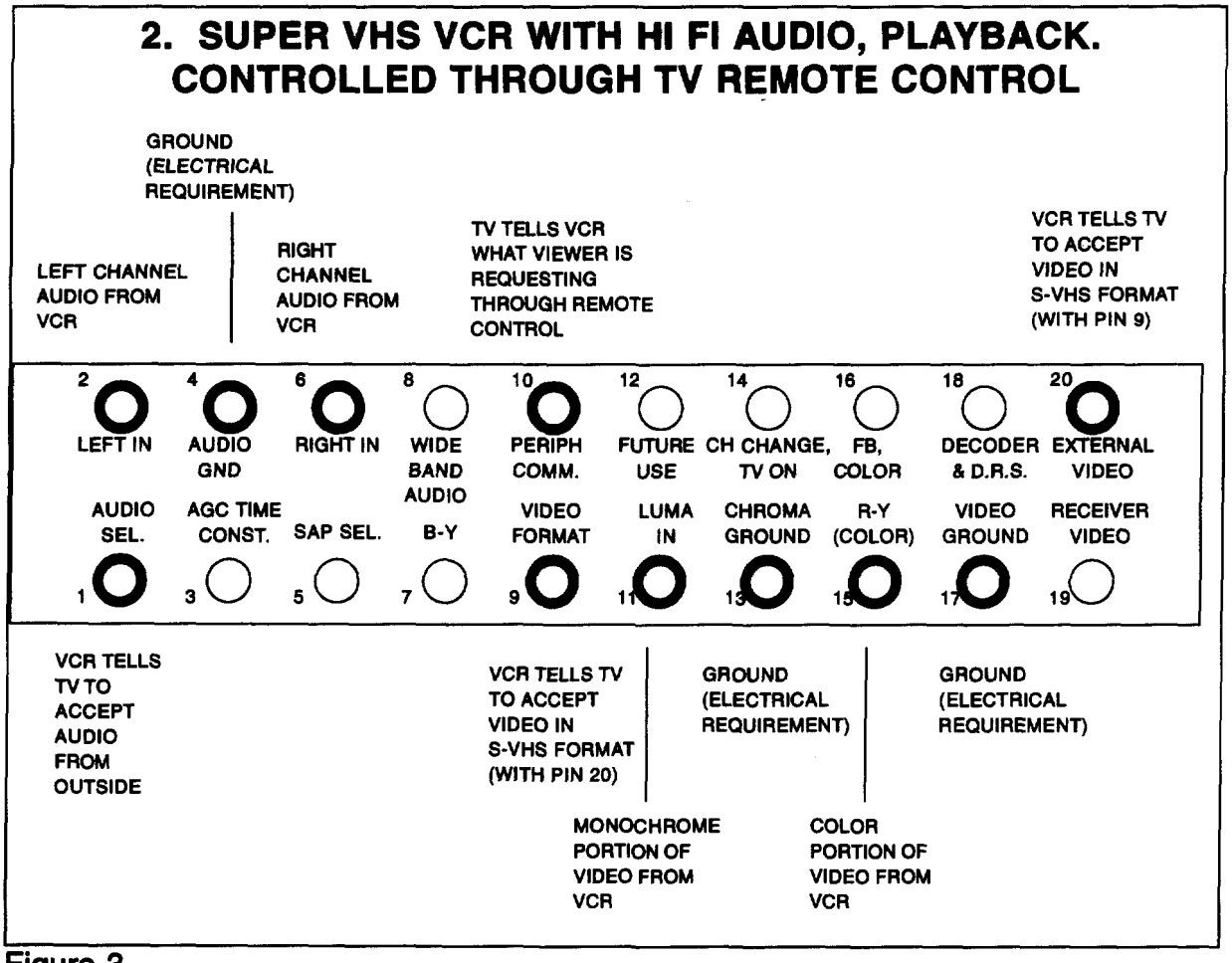


Figure 3

Figure 3 shows the pins used in the S-VHS example. Here we assume that the consumer controls the VCR through his TV remote control, through pin 10. The VCR

supplies video on pins 11 and 15.[2] Audio is supplied on pins 2 and 4. Pins 1, 9 and 20 tell the TV where to find the video and what type of video it is. The other active pins are grounds, needed for optimum quality signals.

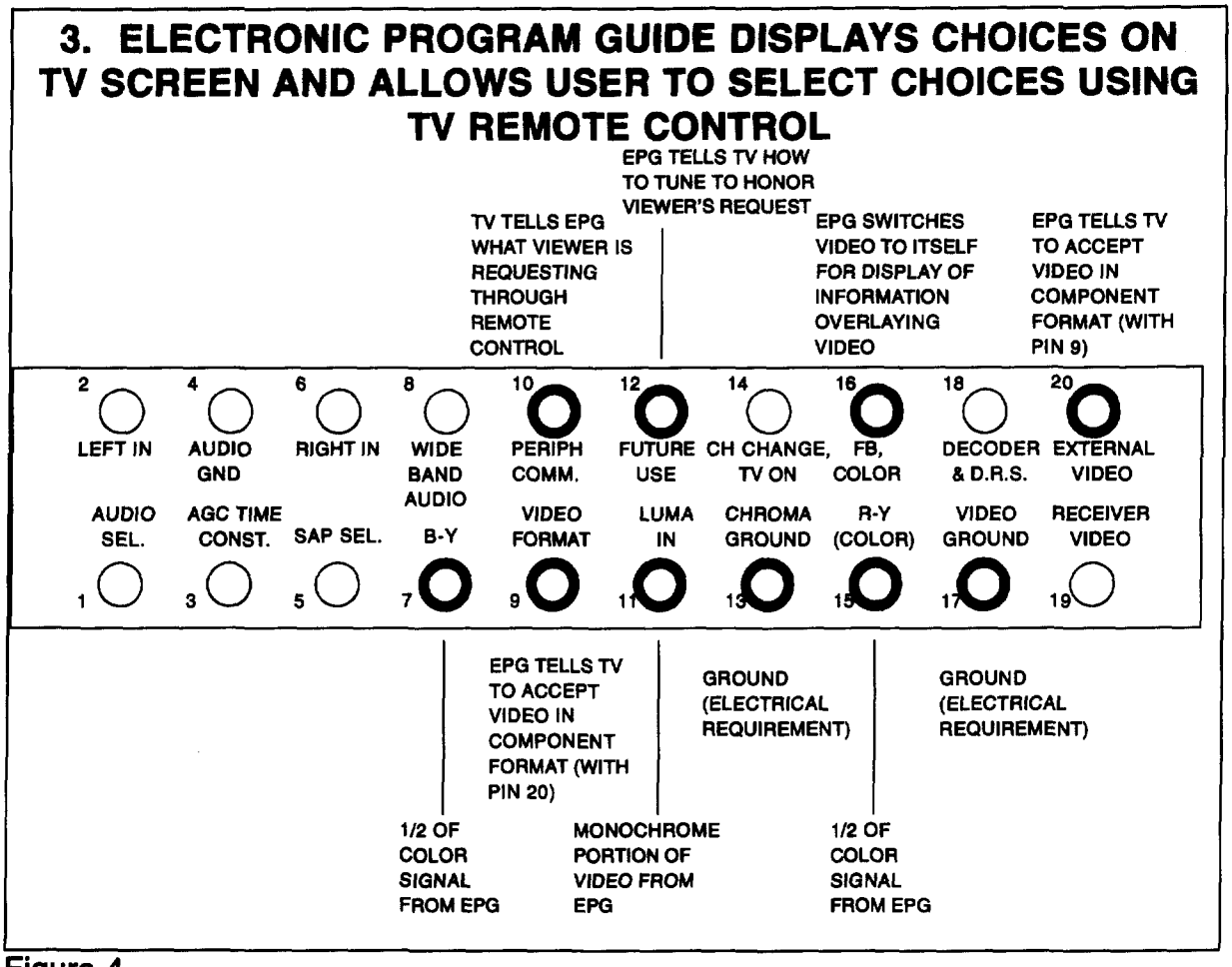


Figure 4

Figure 4 shows the use of Multiport with an electronic program guide (EPG). The EPG box sends its portion of the picture (the text and icon overlay) to the TV on pins 7, 11 and 15.[3] It must change the TV from displaying normal picture to displaying the EPG information very quickly, and this control is accomplished on pin 16. The EPG must be

[2]In order to send the best quality picture possible, the black and white, and color portions of the picture must be sent to the TV separately. This is one of the basic improvements embedded in the S-VHS standard.

[3]In order to get the quality signal needed here, it is best to send it in three parts: the black and white portion, and two color signals.

controlled through the TV remote control, and this data is passed on pin 10. The future use pin, 12, will probably be required to allow the EPG circuitry to control the TV's tuning, allowing the consumer to highlight the program, and have it automatically tuned without the consumer knowing the channel number. The other active pins are used for technical reasons.

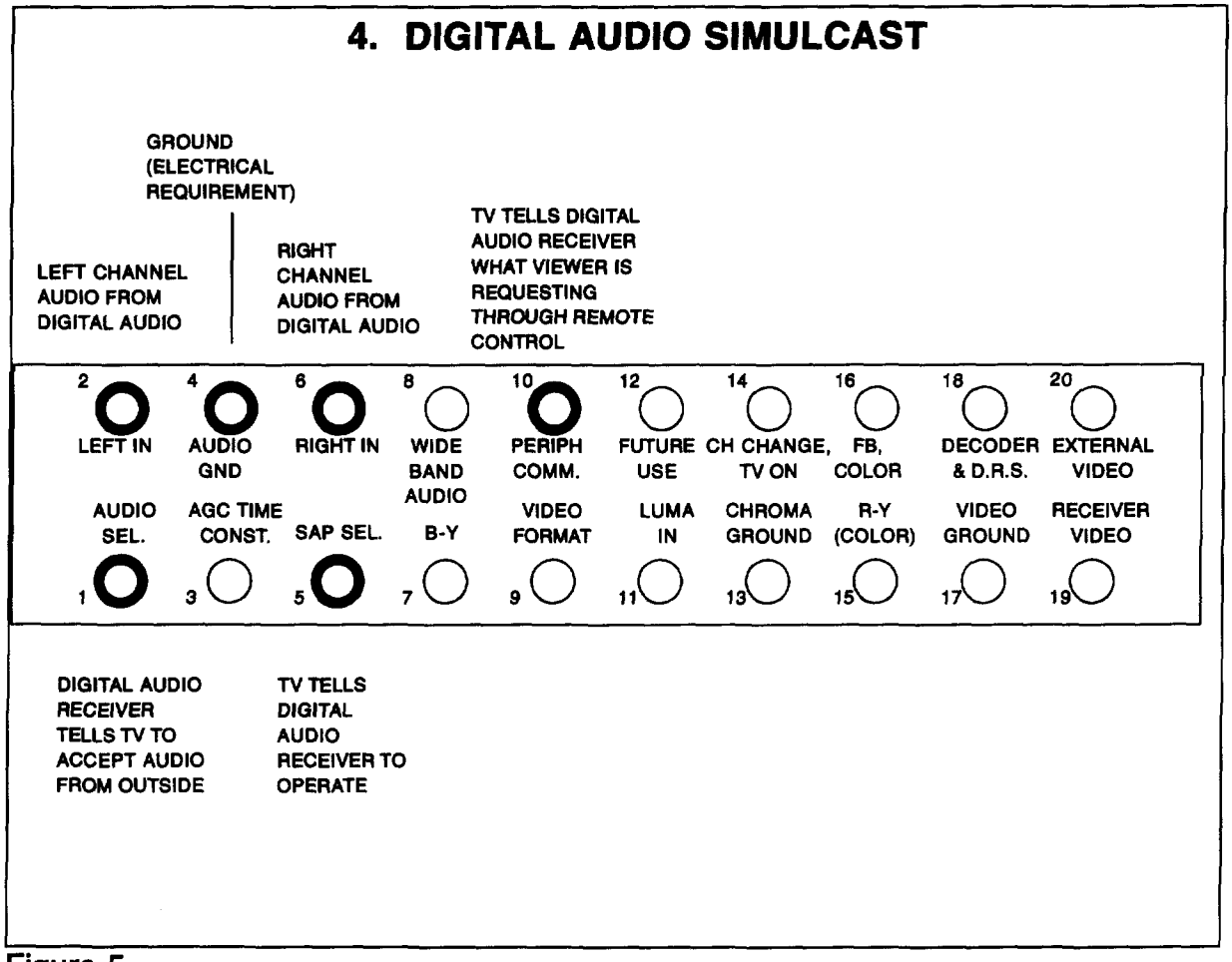


Figure 5

Yet another application is shown in figure 5. Here we are using a digital audio simulcast, in which a viewer is watching, for example, a concert in which audio quality is important. The audio is being sent on a digital audio channel in addition to being sent with the TV signal. In order to view the picture and simultaneously hear the high quality digital audio, the viewer has attached a digital audio receiver to his Multiport plug on the TV set. Pin 5 is used to allow the TV to instruct the digital audio receiver to work.[4] Pin 10 tells the

[4]While not a true application for SAP, the pin can be used for other things such as this, which were not envisioned at the time the Multiport standard was adopted.

digital audio receiver what channel is tuned, and the receiver knows how to tune the corresponding digital audio. The audio is returned to the TV on pins 2 and 6. In this case, the receiver tells the TV to use audio from the outside, but to use its own video.

APPLICATION OF MULTIPORT TO DIGITAL TRANSMISSION

One of the newest proposals for TV transmission is digital compression. A problem with compression is the enormous investment the public has made in conventional analog TV sets. This investment must be preserved in a transition to compression. Due to the investment in conventional TV, and the embryonic stage of digital TV development, we are likely many years from a complete switch-over to digital transmission. In order to begin reaping the benefits of digital transmission earlier, use of a converter is necessary. One way to do so is to use a set top converter to convert the selected compressed signal to a conventional NTSC analog signal, then supply it to the TV. To do so in today's world would require a decompression set top box, which would doom the subscriber to having a set top converter on his TV until digital transmission becomes the normal way of transmitting signals.

An intermediate step is to use Multiport-equipped TVs with a decompression box. The TV will need one more output but this can be placed beside the Multiport connector, and can be connected by the consumer. Once he has such a decompression box, he'll be able to enjoy the benefits of compression without making the investment in a TV set having internal decompression circuitry.

APPLICATION OF MULTIPORT TO HDTV

The same arguments apply, perhaps more strongly, to high definition TV (HDTV). When the HDTV standard is ready for deployment, there will be a most serious "chicken and the egg" problem: with no TV sets in the hands of the public capable of receiving HDTV, broadcasters will have a serious economic problem justifying the considerable cost of HDTV equipment, delaying the time that HDTV is available. However, since the signals aren't available, the public will have no incentive to invest the considerable sum of money that a new HDTV set will inevitably cost at first. This will further delay the time that HDTV set cost can come down as a result of volume production.

A multiport-equipped TV can accommodate a decompression box, and so will be able to be upgraded to HDTV. This could give the public almost instantaneous access to HDTV without having to make the investment in a new and expensive TV set. An add-on decoder is needed, but the cost of such will be much less than the cost of an HDTV set. Granted, the consumer will not have access to the wide screen picture, but he will have the rest of the benefits of HDTV, and a ready market for HDTV programs will exist.

APPENDIX. CATALOG OF PIN FUNCTIONS FOR EIA-563 CONNECTOR

The designations used for the pins are oriented to the needs of the TV set.

PIN 1. *Audio Select.* Allows an external box to decide whether or not the TV or VCR should use audio derived from it's own detector, or to accept audio from the external source. The TV will need to accept audio from the external source to accommodate scrambled audio or user-friendly simulcast.

Loss of this pin would render several of the above illustrated applications of the connector, to be impossible.

PIN 2. *Audio In, Left.* Accepts external audio for the left channel. The impact of loss of this pin should be obvious.

PIN 3. *AGC Time Constant/Video Select.* Works with pin 18 to provide several functions: one of the functions is to select either the TV's internal video, or video from an external source. This is needed in order to allow seamless transition from normal unscrambled video, to a scrambled program.

The other functions are covered in more detail under the description of pin 18. They involve setting the TV up for proper acquisition of a scrambled signal.

This pin was included because it was deemed necessary to adjust the AGC time constant for certain scrambling systems, which didn't maintain the normal relationship between sync in the vertical and horozontal blanking intervals. Loss of this pin would render the standard unusable with those scrambling systems. These scrambling systems remain in use today.

PIN 4. *Audio Ground.* Needed for technical reasons. Audio signal are extremely sensitive to noise picked up from video and digital circuits. A separate ground is designated to allow better audio signal to noise ratio.

Loss of this pin could compromise the quality of audio delivered to the customer.

PIN 5. *SAP Select.* This is used to allow the user to tell an external box to select the second audio program portion of the TV stereo signal. Lack of this pin would require the subscriber to interface to the external box, a point of confusion. A further application of this pin might be to control selection of an FM or digital audio simulcast.

Selection of SAP using this connector is not likely to be important in the future. We have proposed a quite practical use for this pin above, though we conceed that the function could be accommodated in other ways.

PIN 6. *Audio Input, Right.* Accepts external audio for the right channel. The need for this pin is obvious.

PIN 7. *B-Y Channel.* Input for component video, one component of chroma. the other component, if used, is on pin 15. It is needed for improved signals which don't have NTSC artifacts.

Loss of this pin would preclude interfacing using color difference signals, a loss where small graphics and lettering is needed.

PIN 8. *Wideband Audio Out.* This pin was originally conceived as a way of adding an external stereo decoder. As the market has developed, this is not a likely application. However, many systems for analog audio scrambling utilize the audio frequencies carried on this connector, so the need remains.

Loss of this pin could compromise future scrambling systems, and would preclude use of at least one audio masking technique currently available in the market.

PIN 9. *Video Format.* In order to maximize the industry's ability to improve service, we must allow any of several types of video formats to be supplied, and this pin is part of the process of telling the TV which format is being supplied. Pin 20 works with this pin to complete the definition.

Loss of this pin would make it more difficult to control the TV in some of the modes needed, and would render the Multiport standard less robust.

PIN 10. *Communication to Peripheral.* Allows the TV/VCR to send messages to the add-on box. For example, the TV may need to tell the box what channel it is tuning, or that the subscriber has requested a pay-per-view program. In addition, some scenarios have this pin allowing the TV to communicate with other equipment supporting the EIA CeBus protocol.

This pin is essential to future applications of the product, in which one device will control another.

PIN 11. *Luminance Input.* Works with pins 7 and 15 when component video is used to provide higher quality signals than NTSC can provide.

Loss of this pin could cause difficulty in interfacing high quality video with the TV set.

PIN 12. *Reserved.* Will be used as future needs are identified. One such need is suggested here-in.

This pin is likely needed to facilitate communication between the TV set and other

equipment.

PIN 13. *Fast Blanking/Chroma Ground.* This is a ground pin used to provide for better video signal to noise ratio by allowing the chroma (color) signal to be grounded separately.

As with other ground pins on the connector, this one is needed in order to ensure that high quality signals can be delivered, considering all of the circuits operating in close proximity around the TV.

PIN 14. *Channel Change/Power.* This pin tells the external box that the TV is in the process of changing channels, or that the TV is off. The box may need to know of a channel change in order to initiate a signal acquisition process, which is only needed one time each time a signal is tuned. The external box may need to know when the TV is on, for example, if it is tracking TV viewing for a rating firm, or if it is to record billing information for a pay-per-view event. We don't want to record a program not actually being watched, and we certainly don't want to bill for a pay per video program that wasn't watched.

The channel change feature was included because some scrambling system proponents felt that it would speed acquistion of a scrambled signal. The power function was included to ensure knowledge of the state of the TV.

PIN 15. *R-Y Channel.* Input for component video, one component of chroma. the other component, if used, is on pin 7. It would be needed for improved signals which don't have NTSC artifacts.

Loss of this pin would preclude interfacing using color difference signals, a loss where small graphics and lettering is needed.

PIN 16. *Fast Blank/Chroma.* This is needed if an external box needs to superimpose characters over a video signal that is being handled by the TV. For example, suppose an electronic program guide needed to overlay a description of a program, on that or another program. The fast blanking pin would be used to cause the TV to switch at the appropriate time, from the internal video to the overlay. This switching must be done in a few billionths of a second if it is to look good on the screen. Control of switching through other inputs will not allow this fast of a switching operation.

Besides controlling the switching to the external video for the overlay, this pin contains the color information for the overlay. This is one of several examples of pins that are used for more than one function. Using pins for multiple functions allows more versatility in the interface while keeping costs down by using fewer total pins.

This pin is needed to facilitate the use of highest quality on screen displays.

PIN 17. *Video, R-Y, B-Y Ground.* Improves the quality of pictures by isolating the noise from different parts of the system.

As with other ground pins on the connector, this one is needed in order to ensure that high quality signals can be delivered, considering all of the circuits operating in close proximity around the TV.

PIN 18. *Decoder Present, Decoder Restored Sync.* This is another pin with multiple functions. One function is to tell the TV that an external box is present, so the TV should communicate with it. The other function is to allow the receiver AGC to work properly when handling a scrambled signal. Common scrambling systems modify the video signal in ways such that the automatic gain control (AGC) circuits in the TV won't work properly. This pin is used to allow the external box to supply a signal for controlling gain in the TV. Without this, it is conceivable that the TV won't produce a reasonable signal for the external box to use, because the AGC circuit would be confused and would set the TV operating parameters to an inappropriate point for the signal being used.

This pin is absolutely essential if the automatic gain control in the TV set is to work on scrambled signals.

PIN 19. *Receiver Video Output.* This is the pin used to supply video to the external box. The video is supplied scrambled, for example, and is returned to the TV descrambled, on pin 20.

This pin is fundamental to the concept of the Multiport standard.

PIN 20. *Receiver Video Input.* This is the video coming in to the TV from the external box.

This pin is also fundamental to the Multiport concept.